were amended to include the limitation "self-phasing", and as this limitation was said to constitute new matter. The limitation of "self-phasing" has been deleted above from independent claims 1, 12 and 15.

The Office Action also rejected claims 1-18 under §112 as being indefinite with regard to the terms "relatively rigid" and "relatively weak" in claims 1, 12 and 15. These terms have been deleted from claims 1, 12 and 15 above. Claims 1, 12 and 15 have been amended above to indicate that each stabilizer is more rigid in a direction transverse to the line of stroke than the stabilizer is rigid in the direction of the line of stroke. It is respectfully submitted that all of the pending claims 1, 3-13 and 15-18 are now in compliance with the requirements of §112.

In the second full paragraph on page 6 of the Office Action it was indicated that the recitation "adapted to vibrate along a line of stroke" was not given patentable weight because the recitation occurred in the preamble to the claims. Independent claims 1, 12 and 15 have been amended above to delete the recitation "along a line of stroke for conveying" or "along a line of stroke" from the preamble of those claims. Independent claims 1 and 12 have also been amended above to require a plurality of drive springs, each having a central axis wherein each drive spring is adapted to compress and extend along a line of stroke generally parallel to the central axis of the drive spring. Independent claim 15 has similarly been amended to require that each drive spring is adapted to compress and extend along a line of stroke. These limitations are contained in the body of the claims and appropriate consideration thereof is respectfully requested. Claims 2 and 14 which required a plurality of drive springs have been cancelled.

The Office Action rejected claims 1-18 as being obvious over Dumbaugh in view of Rosenstrom. The Office Action indicates that Dumbaugh discloses a vibratory apparatus with a bed

111, a plurality of inclined stabilizers 115, and a plurality of drive springs 114. The Office Action indicates that Dumbaugh lacks the disclosure of two separate pairs of free-wheeling eccentric weights, but that it would have been obvious to a person of ordinary skill in the art to utilize the motors and control system in Rosenstrom in the bed structure of Dumbaugh to reduce cost and increase the durability of the system. Applicant respectfully disagrees.

Independent claim 1 requires that the first and second pairs of rotatable eccentric weights be "free-wheeling" with respect to one another, and that the rotatable eccentric weights are adapted to accumulatively synchronize with one another <u>without</u> being rotationally coupled to one another. The rotatable eccentric weights in Rosenstrom are not free-wheeling with respect to one another as they are rotationally coupled to one another by an electrical control circuit that <u>forces</u> the weights to synchronize with one another. Rather than being free-wheeling with respect to one another as required in the claims, Rosenstrom utilizes shaft encoder devices 58 adjacent each shaft on which the weights rotate and a special electrical control system to "force" the synchronization of the rotating eccentric weights and respective motors. As set forth in the Summary of the Invention in Rosenstrom, one of the modules that includes a rotatable eccentric weight is a master module having a first motor driving a first shaft at a programmed predetermined speed. A shaft position encoder device is associated with the end of each shaft and generates a shaft position feedback signal indicative of the position of the eccentric weight on the associated shaft. A motion controller receives each of the shaft position feedback signals and compares each of the shaft positions with predetermined relative phase angles or positions of the shafts and generates a control signal for each of the shafts whose position is varied from the predetermined position. A motor speed controller, responsive to the control signal for adjusting the speed of one motor of each pair of motors (the

"slave" motor), is associated with the shafts whose relative position is varied until the wanted relative position matches the predetermined position of the "master" motor. Thus the electrical control system in Rosenstrom forces the "slave" motor and shaft to vary its speed and its position to match the position of the "master" motor and shaft. The eccentric weights in Rosenstrom are not free-wheeling with respect to one another and are not adapted to accumulatively synchronize with one another without being rotationally coupled to one another as required in independent claim 1.

Use of the electrical control system as taught by Rosenstrom to electrically force the rotating eccentric weights to phase with one another by varying the speeds of the motors adds cost to the system and increases the complexity of the system, rather than reducing the cost and increasing the durability of the system, as does the present invention. The present invention eliminates the need for the complex electrical control system of Rosenstrom.

Dumbaugh teaches a "connection" to permit the use of independent sections in a counterbalance of long length. Dumbaugh only discloses one motor, and does not suggest the possibility of including first and second pairs of motors with rotatable eccentric weights. There is no teaching in the combination of Dumbaugh with Rosenstrom that first and second pairs of rotatable eccentric weights will properly phase and synchronize with one another when the weights are free-wheeling with respect to one another and are not rotationally coupled to one another, either mechanically or electrically, as required in claim 1. Only the present application of the applicant provides this teaching. Claim 1 is therefore not obvious over these references.

In addition, claim 1 has been amended to require that the rotating eccentric weights are adapted to rotate at substantially the same operating speed with respect to one another. This limitation is supported by the second full paragraph on page 10 of the application, which indicates

that all motors reach full speed, and by the third full paragraph on page 14 of the application which indicates that it must be ensured that each of the motors is rotating at the same speed with respect to one another throughout the range of speed adjustment. As indicated above, the electrical control system in Rosenstrom is used to vary the speed of the slave motor with respect to the master motor in order to force the synchronization of the associated eccentric weights. Rosentrom therefore teaches away from the present invention, such that the present invention is not obvious over Dumbaugh in view of Rosenstrom.

The present invention has accomplished what others skilled in the art have not, namely, the proper synchronization of first and second pairs of free-wheeling rotatable eccentric weights without any mechanical or electrical coupling of the weights to one another to force synchronization. As stated in the application at page 4, the desire to accumulatively phase or synchronize a plurality of pairs of rotating eccentric weights has never been successfully achieved with free-wheeling rotating eccentric weights that are not physically or mechanically rotationally linked or coupled to one another. Rosenstrom teaches that it is impossible to make multiple pairs of vibratory motors and rotating eccentric weights properly synchronize and accumulatively add their output forces and power outputs unless some mechanical or physical connection, such as an electrical control circuit, is used to force this to occur.

It is therefore respectfully submitted that independent claim 1 is not obvious over the combination of Dumbaugh and Rosenstrom. Allowance of independent claim 1 is respectfully requested. Claim 2 has been canceled. Claims 3-11 dependent from claim 1 and are submitted to be allowable therewith.

Independent claim 12 was also rejected as being obvious over Dumbaugh in view of

Rosenstrom. Claim 12 has been amended in the same manner as independent claim 1 to require that the free-wheeling rotating eccentric weights rotate at substantially the same operating speed with respect to one another and that the rotatable eccentric weights are adapted to accumulatively synchronize with one another without being rotationally coupled to one another such that the output forces of the rotatable eccentric weights and their respective power outputs accumulatively add to cause the bed to vibrate along a line of stroke. It is therefore respectfully submitted that independent claim 12 and its dependent claim 13 are allowable over these references for the same reasons as with regard to claim 1.

Independent claim 15 was also rejected as being obvious over Dumbaugh in view of Rosenstrom. Claim 15 has similarly been amended as was claim 1 to require that the free-wheeling eccentric weights operate at substantially the same operating speed with respect to one another and that they are adapted to accumulatively synchronize with one another without being rotationally coupled to one another. It is therefore respectfully submitted that independent claim 15 is allowable over these references. Dependent claims 17 and 18 have been amended to further specify that during adjustment of the rotational speed of the vibratory motors to vary the vibration frequency of the bed, the vibratory motors continue to operate at substantially the same rotational speed with respect to one another. It is therefore respectfully submitted that claims 1, 3-13 and 15-18 are allowable over Dumbaugh and Rosenstrom.

Claims 1-18 were also rejected as being obvious over Dumbaugh in view of Venanzetti. The Office Action states that Dumbaugh discloses a vibratory apparatus with a bed 111, a plurality of inclined stabilizers 115, and a plurality of drive springs 114, but lacks two separate pairs of free-wheeling eccentric weights. Venanzetti is said to teach a plurality of motor and weight pairs in a

vibratory apparatus such that it would be obvious to utilize a plurality of motor and weight pairs as taught by Venanzetti in the bed structure of Dumbaugh.

Independent claim 1 has been amended above to require a plurality of drive springs, wherein each drive spring has a central axis and each drive spring is adapted to compress and extend along a line of stroke generally parallel to the central axis of the drive spring such that the bed vibrates along the line of stroke. The Office Action noted that the requirement that the bed vibrate along the line of stroke was previously in the preamble and was therefore not given any patentable weight. This limitation has now been positively included in the body of claim 1.

Venanzetti combines Figures 1, 2, and 3 to illustrate the invention. The vibrators in Venanzetti have two horizontal rotating shafts 7 and 10. Two eccentric weights 5 and 6 are located on shaft 7 and two eccentric weights 8 and 9 are located on shaft 10. The vibrators are fixed below a common plate 1 as stated in column 1, line 52. The eccentric weights on each shaft are equally offset with one another at an angle of incidence (i) as shown in Figure 3. The two eccentric weights 5 and 8 have a force output of R1 and the two eccentric weights 6 and 9 have a force output of R2. When the weights are rotated in opposite directions, the horizontal components of R1 and R2 are additive and form a force couple in the horizontal plane that develops a "rotary" or "twisting" kind of vibratory motion. The vertical components of R1 and R2 additively combine to develop a "shaking" or "up and down" vibratory motion. Consequently, a beneficial vibratory <u>helical motion</u> used for circular conveying is achieved by the combination of the "rotary" vibratory motion and the "shaking" vibratory motion in Venanzetti. As stated at column 1, line 55 of Venanzetti, the plate 1 is suspended on a bed through a plurality of springs 12 suitable to "ensure freedom of the combined rotary and shaking alternative movement" provided by the vibrators.

In Figure 5, two independent pairs of vibrators 21 and 22 are shown (column 2, line 51). Vibrator 22 is placed at the top, and vibrator 21 is placed under plate 1 at the bottom of a Spiral Elevator. Thus a combined "rotary" (force couple) and a "shaking" motion are achieved, but the stresses are half those generated in Figure 4 (which had only two shafts). In Figure 6, a plurality of vibrators 21, 22, and 28 are arranged on three different parallel planes along the vertical height of a Spiral Elevator. Again a combined "rotary" vibratory motion and "shaking" vibratory motion is provided by each vibrator. In Figure 7, only two vibrator pairs 33 and 34 are used. The planes passing through the shafts of each vibrator pair are vertical. The machine 30 in Figure 7 is subject to combined rotary and shaking motion. (Column 3, line 10). In Figures 8 and 9, only one pair of vibrators is shown, respectively labeled 42a and 42b, and 51a and 51b. (Column 3, lines 26 and 41). By spreading the two vibrators in Figure 9 further apart, by noting dimension "a" in Figure 9, the magnitude of the horizontal force couple can be increased.

The Dumbaugh patent applies to sectionalizing the counterbalance of a long, unidirectional conveyor. Therefore, the vibratory apparatus in Dumbaugh has a linear stroke, wherein the drive springs compress and extend along the central linear axis of each drive spring at an angle of usually 30° to 45° from horizontal to convey the load forward. However, as explained above, Venanzetti teaches the combination of a rotary (horizontal twist) kind of stroke and a shaking (vertically up and down) kind of stroke to achieve a helical, circular stroke at a prescribed "angle of incidence" that is used solely for circular conveying, such as in Spiral Elevators. Therefore, the fundamental linear stroke vibratory conveying action indicated in Dumbaugh would be in conflict with Venanzetti's helical stroke action. It would not be obvious to combine Venanzetti with Dumbaugh due to the

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different vibratory stroke actions of Venanzetti and Dumbaugh.

It is therefore respectfully submitted that independent claim 1 is not obvious over Dumbaugh and Venenzetti. Claims 3-11 depend from claim 1 and are therefore also respectfully submitted to be in condition for allowance.

Independent claim 12 has been amended in a manner similar to claim 1 requiring a plurality of drive springs adapted to compress and extend along a line of stroke such that the bed vibrates along the line of stroke. Claim 12 has also been amended to require a plurality of isolation springs of the type as called for in claim 7. Independent claim 15 has also been amended to require that each drive spring be adapted to compress and extend along a line of stroke such that the rotating eccentric weights vibrate the bed along the line of stroke. It is therefore respectfully submitted that independent claim 12 and its dependent claim 13, and independent claim 15 and its dependent claims 16-18, are allowable over the cited references.

Entry of the above claim amendments is respectfully requested to place the claims in condition for allowance. Allowance of claims 1, 3-13 and 15-18 is respectfully requested. As this Response is being submitted after a Final Office Action, the Examiner is respectfully requested to telephone the undersigned regarding the disposition of this response.

Respectfully submitted,

Date: 1-23-03

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Version with Markings to Show Changes Made

1. (Three-Times Amended) A vibratory conveying apparatus adapted to vibrate [along a line of stroke for conveying] and to convey material, said vibratory conveyor apparatus including:

a bed on which the material is conveyed;

a plurality of drive springs, each said drive spring having a first end, a second end and a central axis, said first end of each said drive spring being attached to said bed, each said drive spring adapted to compress and extend along a line of stroke generally parallel to said central axis of said drive spring;

a plurality of inclined stabilizers, each said stabilizer having a first end, a second end and a longitudinal axis, said first end of each said stabilizer being attached to said bed, said longitudinal axis of each said stabilizer being generally perpendicular to said central axis of a drive spring, each said stabilizer being [relatively] more rigid in a direction transverse to said [the] line of stroke [and relatively weak] than said stabilizer is rigid in the direction of [the] said line of stroke, said stabilizers allowing movement of each said drive spring generally parallel to said central axis of said drive spring and inhibiting movement of each said drive spring generally transversely to said central axis of said drive spring;

a first pair of rotatable eccentric weights coupled to said bed, said first pair of rotatable eccentric weights including a first rotatable eccentric weight and a second rotatable eccentric weight; and

a second pair of rotatable eccentric weights coupled to said bed, said second pair of rotatable eccentric weights including a third rotatable eccentric weight and a fourth rotatable eccentric weight,

said rotatable eccentric weights being free-wheeling [and self-phasing] with respect to one another <u>and adapted to rotate at substantially the same operating speed with respect to one another</u>, each said rotatable eccentric weight adapted to provide an output force generally perpendicular to its axis of rotation<u>, said rotatable eccentric weights adapted to accumulatively synchronize with one another without being rotationally coupled to one another</u>; no weight / not feature of weights

whereby rotation of said first pair of rotatable eccentric weights and rotation of said second pair of rotatable eccentric weights, in combination with said stabilizers, [self-phase and] <u>accumulatively synchronize such that</u> the output forces of said rotatable eccentric weights <u>and their respective power outputs</u> accumulatively add to cause said bed to vibrate <u>along said central axes of said drive springs</u>.

3. (Amended) The vibratory conveying apparatus of claim <u>1</u> [2] including a first pair of vibratory motors, said first pair of rotatable eccentric weights being respectively attached to said first pair of vibratory motors, and a second pair of vibratory motors, said second pair of eccentric weights being respectively attached to said second pair of vibratory motors.

4. (Amended) The vibratory conveying apparatus of claim 3 wherein said drive springs have a natural frequency of vibration and said vibratory drive motors are adapted to rotate said eccentric weights at [an] <u>substantially the same</u> operating speed, said natural frequency of said drive springs being greater than said operating speed of said vibratory motors.

6. (Amended) The vibratory conveying apparatus of claim <u>1</u> [2] including a counterbalance, said second ends of said drive springs and said second ends of said stabilizers being attached to said counterbalance.

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12. (Three-Times Amended) A vibratory conveying apparatus adapted to vibrate [along a line of stroke for conveying] <u>and to convey</u> material, said vibratory conveying apparatus including:

a bed on which the material is conveyed;

a counterbalance;

<u>a plurality of isolation springs attached to said counterbalance, said isolation springs adapted to support said counterbalance;</u>

<u>a plurality of drive springs, each said drive spring having a first end attached to said bed, a second end attached to said counterbalance, and a central axis, each said drive spring adapted to compress and extend along a line of stroke generally parallel to said central axis of said drive spring,</u>

a plurality of stabilizers, each said stabilizer having a first end attached to said bed, a second end attached to said counterbalance and a longitudinal axis, said longitudinal axes of said stabilizers being generally parallel to one another, each said stabilizer being [relatively] <u>more</u> rigid in a direction transverse to [the] <u>said</u> line of stroke [and relatively weak] <u>than said stabilizer is rigid</u> in [the] <u>said</u> direction of [the] <u>said</u> line of stroke<u>, said stabilizers allowing movement of each said drive spring generally parallel to said central axis of said drive spring and inhibiting movement of each said drive spring generally transversely to said central axis of said drive spring;</u>

a first pair of rotatable eccentric weights rotatably attached to said counterbalance, said first pair of rotatable eccentric weights including a first rotatable eccentric weight and a second rotatable eccentric weight; and

a second pair of rotatable eccentric weights rotatably attached to said counterbalance, said second pair of rotatable eccentric weights including a third rotatable eccentric weight and a fourth rotatable eccentric weight, said rotatable eccentric weights being free-wheeling [and self-phasing]

with respect to one another and adapted to rotate at substantially the same operating speed with respect to one another, each said rotatable eccentric weight adapted to provide an output force generally perpendicular to its axis of rotation, said rotatable eccentric weights adapted to accumulatively synchronize with one another without being rotationally coupled to one another;

whereby rotation of said first pair of rotatable weights and rotation of said second pair of rotatable weights, in combination with said stabilizers, [self-phase and] accumulatively synchronize such that the output forces of said rotatable eccentric weights and their respective power outputs accumulatively add to cause said bed to vibrate along said central axes of said drive springs.

15. (Three-Times Amended) A method of vibrating a conveying apparatus [along a line of stroke] to convey material, said method including the steps of:

providing a bed having an inlet end and an outlet end on which material is adapted to be conveyed;

providing a plurality of drive springs, each drive spring having a first end attached to said bed and a second end attached to a support, each said drive spring adapted to compress and extend along a line of stroke;

providing a plurality of stabilizers attached to said bed, each said stabilizer being [relatively] more rigid in a direction transverse to [the] said line of stroke [and relatively weak] than said stabilizer is rigid in the direction of [the] said line of stroke;

providing a plurality of pairs of vibratory motors, each vibratory motor having a rotatable eccentric weight, said eccentric weights being free-wheeling [and self-phasing] with respect to one another, each said vibratory motor adapted to operate at [an] substantially the same operating speed and to provide an output force generally perpendicular to its axis of rotation, said rotatable eccentric

weights adapted to accumulatively synchronize with one another without being rotationally coupled to one another;

operating said vibratory motors to rotate said eccentric weights, such that said rotating eccentric weights [self-phase] accumulatively synchronize and accumulatively add their output forces and their respective power outputs and thereby vibrate said bed along said line of stroke at a vibration frequency; and

operating each said vibratory motor at [a] substantially the same selected operating speed which approaches being equal to, or is less than, the natural frequency of said drive springs which are vibrating said bed.

17. (Three-Times Amended) The method of claim 15 including the step of uniformly adjusting the vibration frequency of said bed by electrically and simultaneously adjusting the rotational speed of each of said vibratory motors, while said vibratory motors continue to operate at substantially the same rotational speed with respect to one another.

18. (Three-Times Amended) The method of claim 15 including the step of adjusting the operating stroke and frequency of said drive springs and stabilizers by use of an electrical control connected to each said vibratory motor for simultaneously changing the rotational speed of said vibratory motors, while said vibratory motors continue to operate at substantially the same rotational speed with respect to one another.